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ABSTRACT

This study investigated associations between infants' prelinguistic communicative behaviors at 9 months and their communication and language performance at 12 and 18 months. The inclusion of both hearing (N=19) and deaf (N=16) infants in the study allowed identification of effects related to the receptive communication modality (vision versus audition) available to the infants. Findings indicated that, for both deaf and hearing infants, characteristics of interactive behaviors at 9 months (including signalling, rhythmic activity, and gaze aversion) are associated with later communicative behaviors. However, the presence or absence of ability to receive auditory communication resulted in similar early interactive behaviors being associated differently with communicative development of deaf and hearing infants. The study concludes that assumptions about "positive" or "negative" characteristics of infants' early interactive behaviors may result in misleading conclusions if infants' hearing status is not considered. Face-to-face and free play situations may be experienced differently and have different meanings for infants whose primary modality for receptive communication is vision instead of audition. (JDD)

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EARLY INTERACTION PATTERNS AND LATER COMMUNICATIVE PERFORMANCE OF DEAF INFANTS

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ABSTRACT

EARLY INTERACTION PATTERNS AND LATER COMMUNICATIVE PERFORMANCE OF DEAF INFANTS

This study compared face-to-face interactions between deaf and hearing infants and their mothers at 9 months with the infants' communicative performance during play with toys at 12 and 18 months. The purpose was to identify stable characteristics of deaf infants' communicative attempts across time and features of their early interactions which were associated with later communication and language performance.

Findings indicated that similar behaviors (e.g., gaze avert, signalling, rhythmic activity) were differentially associated with later communication of deaf and hearing infants. Face-to-face and free play situations may be experienced differently and have different meanings for infants whose primary modality for receptive communication is vision instead of audition.

Early Interaction Patterns and Later Communicative Performance of Deaf Infants

BACKGROUND AND PURPOSE OF STUDY

This research is part of a longitudinal study investigating the impact of deafness on the development of deaf infants with hearing mothers. The purpose of this analysis is to determine whether there are stable characteristics of infants' communicative attempts across time and to identify features of their early interactions which might be predictive of later communication and language development. Bornstein and Ruddy (1984) reported that infants' information-processing abilities at 4 months, as well as differences in mothers' didactic behaviors, predicted cognitive and language functioning at one year of age. The current study expanded the search for stable or predictive relationships by investigating associations between infants' prelinguistic communicative behaviors at 9 months and their communication and language performance at 12 and 18 months. In addition, the inclusion of both hearing and deaf infants in the study allowed identification of effects related to the receptive communication modality (vision versus audition) available to the infants.

METHODS

Sixteen deaf and 19 hearing infants were observed with their mothers in a laboratory situation at each age; 9-month-olds and their mothers were videotaped in a standard face-to-face interaction sequence. (Although the sequence included a "still-

face" or non-responsive mother segment, only the first two-minute interactive play segment was used in this analysis.) At 12 and 18 months, these same dyads were videotaped during a longer "free play" situation with a standard set of toys.

The hearing group included 7 girls and 12 boys; the deaf group included 8 girls and 8 boys. Deaf infants had bilateral, sensorineural hearing losses in the better ear ranging from moderate to profound. Hearing losses had been identified and intervention services initiated before they were deaf infants were 9 months old; approximately one half of the deaf infants' families were receiving instruction in use of manually-coded (signed) English. Periodic assessment of motor and self-help skills indicated that both deaf and hearing infants' development (except for language) was proceeding at a normal rate.

Both groups were relatively advantaged in regard to socio-economic status. Educational level of the mothers in each group ranged from completion of high school through graduate school; all except one family included both parents. One mother was Asian American; all others were European American. English was the language spoken in the homes.

RESEARCH QUESTIONS

The current analyses were prompted by two questions:

1. Are there stable associations over time between infants' early interactive behaviors and later communication and language behaviors?

2. Do those associations differ for deaf and hearing infants?

MEASURES

Nine-month interaction variables

Measures of infants' nine-month interactive behaviors employed in this analysis were selected from a larger group of measures obtained for the face-to-face interactions. Behaviors addressed here were selected due to their apparent conceptual similarity to later communicative behaviors. Only non-vocal behaviors were utilized in the current analysis. Variables included:

1. frequency of signalling mother during interaction, shown by behaviors such as reaching or pointing toward her, leaning toward her, smiling at her;

2. time in rhythmic activity, as when "cycling" or moving arms and legs, rocking, flexing hands and feet during interaction;

3. time spent in gaze avert, or looking away from mother (thus, toward an object or part of own body) during interaction.

Twelve and 18-month variables

Measures obtained from the free play session included both visual and vocal communications:

1. frequency of gestural (prelinguistic) communications directed toward the mother;

2. frequency of all gestural + vocal communications directed toward the mother;

3. frequency of formal language utterances (spoken words and/or signs).

RESULTS

Pearson Product-Moment Correlations were computed separately for relationships from 9 to 12 months, and from 9 to 18 months, resulting in the patterns of correlations shown in Tables 1 and 2.

Infant signalling and later communication

For hearing infants, attempts to signal mother during interactions at 9 months were negatively correlated with the infants' communicative use of gestures at 12 months (r = -.5259, p = .01) and with their combined use of vocal and gestural communication at that age (r = -.6494, p = .001). However, this relationship was not found at 18 months, suggesting that the association is of limited duration.

The fact that signalling tended to correlate negatively with later communication for hearing infants suggests that the primary function of these social signals was to re-engage the mother or to elicit interaction from a mother who was not actively communicating with the infant. (This scenario is supported by an earlier analysis which found that infant signalling to mother increased during the "still-face" episode when mother was asked to be non-responsive [Koester & Trimm, 1991].) Therefore, an infant who displays high frequency of signalling during interactions may be reacting to a mother who is not providing an appropriate level of stimulation, and the negative relationship of signalling with later communication may be the result of lower maternal participation during earlier interactions.

In contrast to the relationship described above, no significant correlations emerge for the deaf infants between earlier non-vocal signaling and later gestural or vocal language skills.

INFANT GAZE AVERT AND LATER COMMUNICATION:

Significant correlations were found for both groups of infants between their earlier tendency to look away from the mother during face-to-face interaction and their later vocal and gestural communication. However, these effects were in opposite directions for deaf and hearing infants.

For hearing infants with hearing parents, the amount of time spent looking away from mother at 9 months was positively correlated with later gestural communication (r = .4514, p = .03) and with combined gestural and vocal communication at 12 months (r = .5239, p = .01). At 18 months, the correlations were no longer significant.

The pattern of relationships between gaze avert and language development for deaf infants with hearing parents was very different from that found for hearing children. In this case, there was only a minimal (negative) correlation between looking away at 9 months and gestural communication at 12 months. Stronger negative correlations emerged at 18 months, with a high amount of earlier gaze avert behavior being associated with diminished use of gestural communication (r = -.5473, p = .01). In addition, there was a significant negative correlation between deaf 9-month-olds' tendency to look away from the mother, and their later overall

language production at 18 months (r = -.4697, p = .03).

These opposing patterns of relationships for the deaf and hearing infants (although at first seemingly counter-intuitive), may have a simple explanation: the act of turning away from a social partner by a deaf infant effectively cuts off one of the most important receptive channels for communication and language, that of vision. Without access to the mother's voice, the main sensory modality which remains for the deaf child in this situation is tactile. While the use of touch may be effective for attention-getting, comforting, or general stimulation, it holds fewer possibilities as a means of communicating information or vocabulary related to the child's focus of interest. Thus, when a deaf child frequently averts gaze from the communication partner, linguistic input is decreased. Results of our analysis indicate that this has negative consequences for later communicative and language development.

By contrast, the mother of a hearing child can continue to provide the child with linguistic information (labels, commentary about the surroundings) while the infant looks away from her and toward those surroundings. Because vocal narration remains accessible to the infant during gaze avert, the implications for later language use are positive rather than negative.

INFANT RHYTHMIC ACTIVITY AND LATER COMMUNICATION:

There was a significant correlation for both groups of infants between rhythmic activity and amount of time spent looking away from the mother. Therefore, it is not surprising that the

relationships between the infants' rhythmic activity at 9 months and their communication at 12 and 18 months were similar to those reported above for gaze avert. For hearing infants there were significant positive relationships between rhythmic activity at 9 months and combined vocal/gestural communication at 12 months (r = .4609, p = .02) and at 18 months (r = .3878, p = .05) as well as with 18 month language production (r = .4677, p = .02). For deaf infants, there was a marginal, negative relationship between earlier rhythmic activity and communication at 18 months (r = -.4106, p = .06). Inspection of the videotapes reveals that much rhythmic activity co-occurs with mothers' use of game routines, nursery rhymes, songs, etc. which involve physical movement of the child's body. If a deaf child looks away during this interaction, he or she reduces access to the mother's language input, which is an important part of these game routines. Even while looking away from the mother, a hearing child continues to receive not only the tactile stimulation, but also the linguistic component of these "routine" interactions, which Ratner and Bruner (1978) posited are especially supportive of language acquisition.

CONCLUSIONS

1. For both deaf and hearing infants, characteristics of interactive behaviors at 9 months are associated with later communicative behaviors.

2. However, the presence or absence of ability to receive auditory communication (thus difference in the primary communicative modality employed) resulted in similar early interactive behaviors being associated differently with communicative development of deaf and hearing infants. The pattern of relationships between early interactive behaviors and later communication differed between the two groups in the following ways:

(a) direction of relationship, (e.g., gaze avert and rhythmic activity were positively associated with later communication of hearing infants but negatively associated with that of deaf infants);

(b) strength of relationship, (e.g., signalling was significantly associated with later communication of hearing but not of deaf infants);

(c) time period in which the association was evidenced, (e.g., relationships between 9-month gaze avert and later communication were stronger at 12 months for hearing children and at 18 months for deaf children.)

3. Assumptions about "positive" or "negative" characteristics of infants' early interactive behaviors may result in misleading conclusions if infants' hearing status is not considered.

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Table 1

Associations (Pearson *r*) Between Hearing Infants' Interactive Behaviors at 9 months and Communication Behaviors at 12 and 18 Months

	12 Months		18 Months		
	Gestural Communication	Gestural + Vocal Communication	Gestural Communication	Gestural + Vocal Communication	Language[1]
Signalling	-.53**	-.65***[a]	.21	-.19	-.35
Rhythmic Activity	.32	.46*	.29	.39*	.47*[a]
Look Away	.45*	.52**	.35[a]	.11	.06

1 Logrithmic transformation was performed to improve distributional characteristics of this variable.

* $p \leq .05$

** $p \leq .01$

*** $p \leq .001$

[a] Pearson *r* significantly different ($p \leq .05$) for deaf and hearing groups.

Table 2

Associations (Pearson *r*) Between Deaf Infants' Interactive Behaviors at 9 months and Communication Behaviors at 12 and 18 Months

	12 Months		18 Months		
	Gestural Communication	Gestural + Vocal Communication	Gestural Communication	Gestural + Vocal Communication	Language[1]
Signalling	-.15	-.02[a]	-.06	.37	-.23
Rhythmic Activity	-.04	-.01	-.29	.11	-.41[+a]
Look Away	-.05	-.03	-.55[**a]	-.04	-.47[*]

[1] Logarithmic transformation was performed to improve distributional characteristics of this variable.

[+] p=.06

[*] $p \leq .05$

[**] $p \leq .01$

[a] Pearson *r* significantly different ($p<.05$) for deaf and hearing groups.